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RESEARCH MEMORANDUM

TRENDS IN NAVY ENLISTED CLASSIFICATION (NEC) INVENTORIES AND THEIR UTILIZATION

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A Division of CNA Hudson Institute

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1. Enclosure (1) is forwarded as a matter of possible interest.

2. This Research Memorandum examines trends in the inventory of NECs associated with the increase in C-school observed since 1979. The analysis finds that the inventory increased in part due to a larger and more experienced force, but also reflects a more skilled (as measured by NECs earned) force holding these factors constant. Analyses of NEC use indicate that utilization rates have remained constant, implying that the increase in the NEC inventory has resulted in better fleet manning.

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TRENDS IN NAVY ENLISTED CLASSIFICATION (NEC) INVENTORIES AND THEIR UTILIZATION

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ABSTRACT

This research memorandum examines the increase in the inventory of Naval Enlisted Classifications (NECs) between 1979 and 1986. Factors that explain the increase are considered. Trends in the utilization of NECs are examined for several alternative definitions of utilization. These trends are examined at the aggregate level and for samples disaggregated by rating and experience.

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INTRODUCTION

Navy enlisted specialized skill training has increased consistently throughout the 1980s. Analyses of this phenomenon have noted that most of the increase has been in skill-progression training, or C-school [1,2]. In 1979, for example, the Navy provided 9,500 manyears of C-school training, which accounted for 30 percent of total specialized skill training. By 1986 there had been an increase of more than 50 percent in C-school training, which now accounted for nearly 40 percent of all skill training.

Most C-schools provide system- or equipment-specific training for enlisted personnel who are already rated (qualified in an occupation). The training normally results in the award of a Navy Enlisted Classification (NEC) code, which designates an individual as qualified to work in a specialized billet that requires that skill. Earlier studies have indicated that the additional training conducted by the Navy has indeed resulted in a comparable increase in the number of NECs awarded. This paper examines the resulting changes in the Navy's inventory of NECs and provides preliminary analyses of the way in which those NECs were utilized.

THE DATA

Data used in this analysis are from the CNA-held Enlisted Master Record (EMR) files for September of each year from 1979 to 1986. Yearly endstrength estimates are computed as all enlisted personnel on these September[1] EMR files, excluding any losses. Information such as length of service (LOS), paygrade, and rating are all as of September of the year under consideration.

The EMR files have information on both NECs and Distribution NECs (DNECs). For each individual record, there are five NEC fields (listed in order as primary, secondary, etc.), along with the effective or award date of each NEC. For this analysis, the NEC inventory estimates are computed using all five NEC fields. The inventories are thus counts of all NECs recorded on the EMR as of the end of the fiscal year.[2] The effective or award date is not used. There was concern that fiscal year estimates of the NEC inventory based on September EMRs may understate the "true" inventory if there is a lag in reporting NECs to the EMR. Analysis of NEC reporting was conducted [4], and the inventories adjusted based on estimates of the lag.

There are two DNEC fields, denoted DNEC1 and DNEC2. These fields indicate the NEC requirements of the individual's assignment. Both fields are blank if the individual is not detailed to an NEC requirement. If the individual is distributed to the activity to fill two NEC requirements, both fields contain NEC codes. Estimates of the number of people serving in billets requiring NECs are computed using both DNEC fields.

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1. End of fiscal year.
2. Defense Grouping NECs were excluded from the inventory since they are not earned via formal training. See [3], the NEC manual, for a more detailed description of NEC types.

THE INVENTORY OF NECs

Table 1 displays the yearly aggregate inventory of NECs, endstrength totals, and average NECs held per individual from 1979 through 1986. The growth in the inventory of NECs in the Navy is apparent. The total inventory increased 40 percent over the period. Some of the growth is to be expected, given the contemporaneous (14 percent) increase in endstrength, but the average number of NECs per person was also up--by 23 percent. Many changes in Navy manpower policy occurred over this period. Retention was up, leading to an older force; the mix of ratings changed; and sea-shore rotation rates were altered, among other things. The rest of this section considers how the increase in the NEC inventory was affected by some of these changes.

TABLE 1

NEC INVENTORY TRENDS: FY 1979 to FY 1986

	NEC inventory (000s)	Endstrength (000s)	Average NECs held
1979	268.7	456.5	.59
1980	266.9	458.4	.58
1981	277.8	469.1	.59
1982	290.9	478.9	.61
1983	311.2	494.1	.63
1984	330.3	501.5	.66
1985	353.5	507.6	.70
1986	375.8	519.6	.72
Change, 1979-86 (percent)	40	14	23

The most frequently noted change in the Navy's manpower situation is the increase in retention that occurred during the 1980s. This increase in retention led to substantial changes in the mix of first-term, second-term, and career personnel in the force. In the following tables, first-term personnel are defined as those in LOS cells 1 through 4, second-termers as personnel in LOS 5 through 9, and career personnel as those with more than nine years of service. This breakdown is only approximately correct, as initial contracts are frequently longer than four years and reenlistment decisions may be made at other times.

Table 2 displays the total size of each of these components of the force over time as well as their relative proportions. Between 1979 and 1986, the proportion of first-termers fell from 58 percent to 50 percent. It is clear from this table that the growth in Navy endstrength

occurred in the second-term and career portions of the force as a result of the large gains in retention.

TABLE 2

ENDSTRENGTH BY LOS CATEGORY

	LOS 1-4 (000s)	LOS 5-9 (000s)	LOS 10+ (000s)
1979	263.9	92.9	99.7
(percent)	(58)	(20)	(22)
1980	265.3	94.1	99.0
(percent)	(58)	(21)	(22)
1981	263.5	102.6	101.0
(percent)	(57)	(22)	(22)
1982	261.1	113.0	104.8
(percent)	(55)	(24)	(22)
1983	259.7	124.6	109.8
(percent)	(53)	(25)	(22)
1984	255.4	131.5	114.6
(percent)	(51)	(26)	(23)
1985	251.5	136.5	119.5
(percent)	(50)	(27)	(24)
1986	258.1	135.3	126.2
(percent)	(50)	(26)	(24)

While previous analyses of C-school training have indicated that a substantial portion of such training occurs early in the first term, it is still the case that personnel who have completed their first enlistment are likely to have earned more NECs than those who have not. The increase in the number of NECs possessed by Navy personnel can be explained, at least in part, by their increased average experience as a result of high retention rates. To analyze the importance of this phenomenon as an explanation of the increased number of NECs in the force, separate analyses of the trends in the NEC inventory were conducted by career status.

Table 3 shows the number of NECs in the inventory, average NECs per person, and the proportion of personnel holding at least one NEC by

TABLE 3

NEC DATA BY LOS CATEGORY

	NEC inventory (000s)			NECs per person				Fraction holding at least one NEC			
	1-4	5-9	10+	1-4	5-9	10+	Total	1-4	5-9	10+	Total
1979	57,534	71,652	139,465	.22	.77	1.40	.59	.20	.55	.74	.39
1980	55,500	71,954	139,486	.21	.76	1.41	.58	.19	.54	.74	.38
1981	56,932	77,099	143,765	.21	.75	1.42	.59	.20	.53	.75	.39
1982	57,674	84,571	148,690	.22	.75	1.42	.61	.20	.52	.75	.40
1983	60,500	95,343	155,344	.23	.77	1.41	.63	.21	.54	.75	.41
1984	63,302	102,741	164,278	.25	.78	1.43	.66	.22	.54	.75	.43
1985	65,026	111,806	176,677	.26	.82	1.48	.70	.23	.56	.77	.45
1986	67,139	116,909	189,703	.27	.86	1.50	.72	.24	.57	.77	.45
Change, 1979-86 (percent)	20	63	36	23	12	7	23	20	4	5	17

year and by career status. The proportional growth in the NEC inventory was largest in the second-term portion of the force (63 percent). The inventory growth was substantially smaller in the career force (36 percent), and even smaller in the first-term (20 percent). When the NEC inventory is calculated on a per-person basis, however, the results are significantly different. Although first-termers were still much less likely to hold NECs, the number of NECs per person and the likelihood of holding an NEC grew faster for first-termers than for more senior personnel. This result is consistent with earlier findings that first-term personnel were receiving an increasingly large portion of C-school training.

It is also interesting to note that most of the growth in NECs per capita and in the fraction of personnel holding NECs occurred between 1983 and 1986.

As the Navy has grown, the shift to a more experienced force has not been the only change. As new platforms and weapon systems have been introduced, the mix of ratings has also shifted. Certain ratings have increased in size relative to other ratings. This fact is evidenced in the second column of table 4, which gives the endstrength growth between 1979 and 1986 by rating group.[1] The growth in endstrength varies substantially across groups. The precision-equipment ratings grew the most, by 68 percent. Other rating groups with an above-average growth rate include the Deck: technical; Electronics; Medical; and Aviation: highly technical groups.

If the number of NECs required varies substantially by rating, then changes in the mix of ratings in the Navy may be responsible for a portion of the increase in average NECs. The number of NECs enlisted personnel are likely to obtain in different ratings is also illustrated in table 4. The rating groups are ordered by the average number of NECs per capita in 1979. Several facts become apparent from this table. First, there are substantial differences in the number of NECs per capita across different rating groups. Second, endstrength has generally grown faster in the rating groups with a higher initial number of NECs per person. For example, in 1979 the Electronics rating group had the highest average number of NECs. These ratings also experienced one of the highest personnel growth rates. Thus, it appears that the increase in the overall average number of NECs held may also in part be explained by the shift in ratings mix to more NEC-intensive ratings.

1. The allocation of ratings to rating groups is given in appendix A.

TABLE 4

NEC INVENTORY CHANGES BY RATING GROUP

	Endstrength in 1979 (000s)	Endstrength growth 1979-1986 (percent)	Average NECs in 1979	Growth in average NECs 1979-1986 (percent)
Electronics	18.9	24	1.34	29
Aviation: highly technical	25.4	19	1.24	19
Aviation: technical	28.8	1	.97	29
Deck: technical	18.1	40	.89	15
Ordnance	22.8	14	.82	25
Medical, dental	25.6	20	.69	6
Precision equipment	0.7	68	.65	10
Aviation: semitechnical	34.5	7	.63	35
Engineering, hull	78.9	14	.62	30
Administrative, clerical	85.4	14	.55	7
Construction	10.0	14	.40	8
Deck: other	17.7	17	.36	12
Nonrated	89.7	8	.03	16
Total	456.5	14	.59	23

DECOMPOSING THE CHANGE IN THE NEC INVENTORY

The preceding section discussed some of the factors that have contributed to the increase in the number of NECs: changes in endstrength, LOS mix, and rating mix. The relative effects of these different factors can be measured by means of a comparatively simple decomposition of the change in the total NEC inventory. The decomposition technique is described in detail in appendix B. In short, the change in the number of NECs is decomposed into four components, indicating the separate effects of changes in endstrength, skill mix, LOS mix, and the number of NECs per capita. Each component is calculated by letting one of these variables change while holding the other three constant.

Two alternative methods are used to decompose the change in the NEC inventory. The methods differ in the way in which variables are held constant in the calculations. In the first method, a variable is held constant at its average value, that is, the average of its 1979 and 1986 values. In the second method, a variable is held constant at its initial (1979) value. The second method has intuitive appeal in that it answers the question: Starting from 1979, what would have happened to the NEC inventory if only one variable (such as endstrength) had changed? One disadvantage of this method is that it cannot be used to decompose the change in the NEC inventory into precisely four components, one for each of the factors; there is also an interaction term, representing the combined effect of changes in all four factors. The first method, in contrast, results in four components that add up to the total change in the number of NECs.

The first component of the change in the NEC inventory is calculated by multiplying the change in endstrength by NECs per capita. Multiplying these two gives an estimate of the predicted growth in the number of NECs if nothing other than total endstrength had changed.

The calculation based on overall endstrength ignores the fact that not only did endstrength grow but that it grew differentially across rating and LOS cells. The second component of the change in the inventory of NECs is calculated holding NECs per capita, the LOS mix, and total endstrength constant but accounting for changes in the proportions of personnel in each of the 13 rating groups. This yields an estimate of the increase in the number of NECs if only the ratings mix had changed. The third component accounts for changes in the LOS mix within rating groups holding endstrength, the rating mix, and NECs per capita constant. The last component of the change in the NEC inventory is calculated by holding endstrength and the distribution of personnel by rating groups and LOS constant, but accounting for changes in NECs per person within rating-LOS cells.

The NEC decomposition results using the two methods described above are summarized in table 5. The relative importance of each component is indicated by the proportion of the change explained by the component.

TABLE 5

DECOMPOSITION OF THE CHANGE IN THE NAVY'S NEC INVENTORY
1979 TO 1986

	Method 1: Average Values		Method 2: Initial Values	
Reason for change	Change in number of NECs	Proportion	Change in number of NECs	Proportion
Endstrength	41,442	.39	37,191	.35
Rating mix	4,984	.05	4,541	.04
LOS mix (retention)	25,016	.23	23,606	.22
Average NECs	35,658	.33	33,384	.31
Interaction	NA	NA	8,378	.08
	107,100	1.00	107,100	1.00

Consider first the results when variables are held constant at their average values. The largest portion of the change in the NEC inventory, 39 percent, is attributed to the increse in endstrength. Only 5 percent of the change is attributed to changes in the rating mix, while 23 percent is attributed to increased retention. One-third of the change in the NEC inventory is not explained by any of these three factors, but rather represents an increase in the amount of training per person within rating-LOS cells.

Next, consider the results when variables are held constant at their initial values. Eight percent of the change in the NEC inventory is attributed to the interaction of changes in the four factors. If the interaction term is removed from the total, the proportions of the change in the inventory that are allocated to the four factors are about the same as the proportions under the first method.

NEC UTILIZATION

Between 1979 and 1986 the Navy added more than 100,000 NECs to the inventory while adding only 63,000 personnel. The question explored in this section is: How well have the additional NECs been utilized?

Before calculating utilization rates, it is worth looking at trends in the assignment of individuals to jobs requiring NECs. When such an assignment is made, a Distribution NEC (DNEC) is put on an individual's record. A person can have up to two DNECs at a time.

Table 6 presents some information about DNECs during the 1979 through 1986 period. The number of DNECs increased greatly during this time, but not as much as the number of NECs (see table 1). The fraction of people with at least one DNEC grew slightly; only about a third of the force was distributed to one or more NECs, however. Not everyone who is assigned to an NEC actually possesses the NEC. The last column of the table shows the fraction of the time that an individual's DNEC matched one of his NECs. The fraction of DNEC/NEC matches increased during the period. Still, 17 percent of DNECs did not match an NEC in 1986. Possible reasons for nonmatches are discussed later in this section.

TABLE 6

DNEC TRENDS

Year	Number of DNECs (000s)	Fraction of people with at least one DNEC	Fraction of DNECs with NEC match
1979	153.7	.31	.75
1980	148.5	.30	.76
1981	149.4	.29	.77
1982	159.0	.30	.77
1983	174.9	.32	.77
1984	181.1	.32	.79
1985	191.5	.33	.80
1986	199.8	.34	.83
Change, 1979-86 (percent)	30	12	11

Attention is now turned to the question of measuring the rate of utilization. The utilization rate for a skill is defined as the ratio of the number of people using the skill to the total number of people

possessing the skill.[1] Unfortunately, problems arise in measuring both the numerator and the denominator of this expression.

Measuring the number of people who possess a skill is somewhat complicated. It is easy to count the number of people who have a particular NEC on their record. There are, however, lags in reporting earned NECs to the EMR, which means that this count will probably be an underestimate of the number of people possessing the skill.

Analysis of the lag in reporting NECs to the EMR is described in [4]. In that analysis, quarterly EMRs from June 1983 to June 1984 and June 1986 to June 1987 were used to compare the quarter a "new NEC" appears (an NEC not on the individual's record in the previous quarter) to the award date (month/year) of that NEC. In general, there appears to be a very short reporting lag. In fact, it is estimated that about 92 percent of NECs awarded have at most a one-month reporting lag. Using current data to estimate the NEC inventory should therefore lead to an undercount of less than 5 percent.

It is assumed here that an NEC is being utilized only by people who are distributed to that NEC, that is, those who have that NEC as one of their DNECs. In other words, although skills learned in earning an NEC may be generally useful, they will not be counted as being utilized unless the person is assigned to a billet that requires an NEC. One complication is that a substantial proportion of personnel with a DNEC do not have that NEC on their record (see table 6). Should all DNEC holders be counted as using the NEC, or only those who possess the NEC as well?

There are a number of reasons why an individual may have a DNEC without a matching NEC. One reason is reporting lags. Many people are sent to school to earn an NEC en route to their next job. Detailers give such people a DNEC in the expectation that they will soon possess the NEC as well. Most do earn the NEC, but it is not recorded immediately. On the other hand, some fail to earn the NEC, but their DNECs are not changed to reflect this fact.

An individual with a DNEC but no matching NEC may be in the process of earning the NEC through on-the-job training (OJT). Historically, some NECs were earned through formal training followed by a required period of OJT. An individual was likely to be assigned to an NEC billet immediately after leaving school and, therefore, would have a DNEC but not the NEC until the OJT requirement was complete.[2]

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1. At an aggregate level, utilization can be defined in terms of number of people or number of NECs.
2. This practice was ended in 1987 and current Navy policy for these NECs awards the NEC upon completion of formal training.

Another possible reason for the lack of a DNEC/NEC match is that the individual possesses an NEC that is a substitute for the NEC to which he is distributed.[1] In practice, some NECs may be virtually interchangeable with others and probably should be thought of as constituting an exact match. Other NECs may be close enough that the detailer could decide (with the concurrence of the activity to which the person is assigned) to assign someone with the substitute NEC if waiting for an exact match would create a long delay in filling the billet.

Finally, the individual may just have been detailed incorrectly, that is, without any relevant skills. It is unclear why, or how often, this situation arises. One explanation that has been offered is that, when there is no C-school seat immediately available, a person may be sent to a command with the understanding that he will go to school later (or perhaps earn the NEC on the job). For various reasons, the individual never reaches C-school.

In any case, it appears that some, but not all, of those who have a DNEC but no matching NEC actually possess the skills required for that NEC.

DEFINITIONS OF UTILIZATION

This paper is concerned with measuring NEC utilization at the aggregate level, that is, for all NECs combined. At this level, utilization can be defined in two ways: using the number of NECs as the unit of measurement or using the number of people. The distinction arises because people can have more than one NEC or DNEC; thus, one person can count as, say, three NECs.

The first set of definitions of utilization uses the NEC as the unit of measurement. The first measure, U1, is the ratio of the number of NEC/DNEC matches to the total number of NECs. This measure assumes that anyone distributed to an NEC who does not have the NEC does not really possess that skill (and so is not using it). This is equivalent to assuming that there is no substitution among NECs and no reporting lags.

It seems reasonable to assume that some proportion of those distributed to an NEC who do not appear to have the NEC are using substitute skills. The second measure of utilization, U2, is formed by adding

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1. The NEC manual distinguishes principal, component, and related NECs. A component NEC is a prerequisite for a principal NEC, while a related NEC has a "significant relationship to a principal NEC" but is not a prerequisite for it. When an individual earns a principal NEC, any component or related NECs are removed from his record. However, an individual with a principal NEC may be detailed to a component or related NEC.

the number of DNECs without an NEC match to the numerator of U1. This gives the ratio of the total number of DNECs (whether they match an NEC or not) to the total number of NECs. The assumption here is that everyone with a DNEC possesses either a matching NEC or a substitute NEC. No adjustment is made to the denominator since the substitute NECs are already included in the inventory. This measure does not address the question of reporting lags.

Generally, U2 will exceed U1. U1 and U2 will be equal only if all individuals with DNECs have matching NECs. As the number of individuals distributed to an NEC who do not have the NEC increases, U2 increases relative to U1. If nonmatches between NECs and DNECs occur primarily because of substitution between NECs, and if unreported NECs are not a problem, U2 will be a better measure of utilization than U1. If, however, nonmatches occur primarily because of undocumented NECs, other adjustments are necessary.

As noted above, the lag in reporting NECs to the EMR leads to a small undercount of the NEC inventory. This undercount affects both utilization measures. Underreporting of NECs will reduce the denominator of U1, since the NEC inventory will be underestimated, but it will also reduce the numerator, which counts the number of matched DNECs. An adjustment to U1 to account for reporting lag requires assumptions about the utilization of unreported NECs. If personnel with unreported NECs utilize those NECs at the same rate as other NEC holders, then U1 will not be changed by an adjustment for reporting lag. If one assumes that unreported NECs are recently awarded, and that recently earned NECs are more likely to be utilized, then U1 will slightly underestimate the true utilization rate. Because empirical evidence does not exist on this issue, no adjustments were made to U1.

Reporting lag affects only the denominator of U2. The third utilization measure, U3, defines utilization in the same way as U2 but uses estimates of the reporting lag to correct for the undercount of the NEC inventory. Specifically, U3 is the ratio of total DNECs to 1.05 times the NEC inventory. Estimation of the reporting lag indicates that the NEC inventory is understated by less than 5 percent, so U3 is felt to be conservative. Note that a 5-percent increase in the inventory will decrease the unadjusted utilization rate (U2) by less than 5 percent.

The three utilization measures described so far have used the total number of NECs (or DNECs) as the unit of measurement. An individual can have up to five NECs recorded on the EMR and at most two DNECs. Each individual can therefore be counted as many as five times in the NEC inventory, although he can be counted as using NECs at most two times. Thus, individuals with more than two NECs will have utilization measures of less than 1.

Table 7 shows maximum achievable utilization rates from 1979 to 1986 when account is taken of the fact that an individual can use only one or two of his NECs at a time. The numbers in the first column are ratios of the number of "first" NECs (that is, the number of NECs excluding individuals' second through fifth NECs) to the total NEC inventory, while those in the second column are ratios of the number of first and second NECs to the total inventory. Both fractions are fairly constant until the last three years of the period, when the proportion of NECs in the third through fifth positions increased.

TABLE 7

MAXIMUM UTILIZATION RATES

	Using one NEC only	Using two NECs
1979	.66	.89
1980	.65	.89
1981	.65	.89
1982	.66	.89
1983	.66	.89
1984	.65	.89
1985	.64	.88
1986	.63	.88

While billets can specify either one or two NECs, it appears that in practice few billets require two. In November 1985, for example, 62 percent of billets authorized required no NECs, 33 percent required one NEC, and only 5 percent required two NECs. The maximum achievable utilization rate is therefore closer to the numbers in the first column of table 7 than to those in the second column.

The utilization rates in table 7 can be used as a point of reference for the values of U1, U2, and U3 to be presented in the next section. It should be kept in mind, however, that a maximum achievable utilization rate is not necessarily the same as an optimal utilization rate.

As an alternative to defining NEC utilization in terms of NECs, utilization can be defined in terms of people. Under such a definition, an individual would be counted at most once in the NEC inventory or in the group of NEC users. The two measures of utilization defined in this way, PU1 and PU2, are analogous to U1 and U2. PU1 is the ratio of the number of people with at least one NEC/DNEC match to the number of people with at least one NEC. PU2 is the ratio of the number of people with at least one DNEC to the number of people with at least one NEC.

PU1 and PU2 are expected to be greater than U1 and U2. This is because, when translating a utilization measure from NECs into people, the denominator (the NEC inventory) should decrease more than the numerator (the DNEC inventory).

The NEC-based measures of utilization can be thought of as answering the question: What proportion of training is being utilized? The personnel-based measures can be thought of an answering the question: What proportion of trained people are using their training? Both types of measure yield insights into how training is being used; both are of interest in addressing the issue of how much training should be done.

AGGREGATE NEC UTILIZATION

Table 8 presents estimates of the three NEC-based utilization measures by fiscal year for all Navy enlisted personnel.[1] Again the first (U1) counts personnel as utilizing an NEC only if they have a DNEC and an exactly matching NEC on their record. The second measure counts all DNECs whether they match an individual's NEC or not. The third measure is similar to the second but assumes that the NEC inventory is underestimated by 5 percent. Note that $U2 \geq U1$ and $U2 > U3$. U2 and U3 increase relative to U1 as the number of unmatched DNECs increases.

TABLE 8

NEC-BASED UTILIZATION MEASURES

	U1 (matched DNECs only)	U2 (all DNECs)	U3 (all DNECs; NECs adjusted for underreporting)
1979	.43	.57	.54
1980	.42	.56	.53
1981	.42	.54	.51
1982	.42	.55	.52
1983	.43	.56	.54
1984	.43	.55	.52
1985	.43	.54	.52
1986	.44	.53	.51

If underreporting of NECs was the major cause of unmatched DNECs, and if the utilization rate of unreported NECs was about the same as that for reported NECs, then U3 would approach the value of U1. As

1. Appendix C includes supporting data tables.

shown in table 8, U3 is slightly lower than U2 but is still much higher than U1. This indicates that NEC substitution and incorrect detailing account for some unmatched DNECs.

Part of the difference between U1 and U3 is the result of the use of substitute NECs to fill other NEC requirements. While the difference between the two measures declined during the period studied, it remained significant. Which measure is appropriate depends on an assessment of how much substitution, if any, is appropriate and how much incorrect detailing occurs. That assessment will not be undertaken here. The two measures provide bounds on the true utilization rate, however.

The different utilization definitions result in different estimates of the NEC utilization rate. While the absolute answers are different, the trends over time do not differ dramatically. At the aggregate level, these results indicate that NEC utilization has remained relatively constant. A constant utilization rate, given the large increase in the NEC inventory, implies that much more training is being used by Navy personnel.

Table 9 presents estimates of the two personnel-based measures of utilization. The first measure, PU1, is the ratio of the number of personnel with at least one NEC/DNEC match to the number of personnel with at least one NEC. The second, PU2, includes all DNECs, whether there is an NEC match or not.

TABLE 9

PERSONNEL-BASED UTILIZATION MEASURES

	PU1 (matched DNECs only)	PU2 (all DNECs)
1979	.61	.79
1980	.60	.78
1981	.59	.75
1982	.60	.76
1983	.61	.77
1984	.61	.75
1985	.61	.75
1986	.64	.75

These personnel-based NEC utilization measures are, as expected, much higher than the NEC-based measures. They do, however, exhibit a similar trend over the 1979 to 1986 time period. Note that the measures using matched DNECs only--U1 and PU1--rose slightly over the period,

while the measures using all DNECs--U2 and PU2--declined slightly. This reflects the fact that the ratio of unmatched DNECs to the NEC inventory fell between 1979 and 1986. In any case, it appears that, at the aggregate level, the utilization of personnel holding at least one NEC has remained relatively constant.

NEC UTILIZATION BY LOS CATEGORY

Table 10 shows four utilization measures by LOS category for fiscal years 1979 and 1986.[1] In both years and using all four measures, personnel with 10 or more years of service have the lowest utilization rates. For all measures except PU1, first-term personnel are the most likely to be using their NECs. These patterns are found in the intervening years as well.

TABLE 10

NEC UTILIZATION BY LOS GROUP

	LOS groups			
	1-4	5-9	10+	Total
U1				
1979	.56	.50	.34	.43
1986	.62	.50	.34	.44
U2				
1979	.83	.64	.43	.57
1986	.78	.59	.41	.53
PU1				
1979	.61	.65	.58	.61
1986	.66	.67	.59	.64
PU2				
1979	.87	.81	.71	.79
1986	.83	.78	.68	.75

Since most C-school training takes place in the first-term, the decline in utilization as LOS rises may indicate that NECs possessed by first-term personnel are, on average, newer and so are more likely to be used. First-termers also hold fewer NECs and therefore do not have the

1. Measures of utilization by LOS group for all fiscal years (1979 to 1986) are given in appendix C.

problem of being unable to use multiple NECs. Thus, the differences in utilization rates across LOS groups are much smaller for the measures PU1 and PU2 than for U1 and U2.

Several points become apparent from examining the trends in utilization by LOS group. First, there was more variation over time in utilization for first-term personnel than for second-term or career personnel. For all measures except U2, the largest change in utilization between 1979 and 1986 occurred in LOS 1-4. Second, the pattern of variation over time was very similar for second-term and career personnel. The contrast between first-term and more senior personnel is especially strong when U1 is employed. Between 1979 and 1986, I1 for first termers increased by more than 5 percentage points, while U1 for personnel with higher LOS showed virtually no change.

As noted in the analysis of the NEC inventory, the distribution of endstrength has shifted to the more senior LOS cells. Because senior personnel have lower utilization rates, the aggregate utilization rate was slightly lower in 1986 than it would have been otherwise. Analysis of this effect indicates that measured utilization rates would have been 1 to 2 percentage points higher in 1986 without the change in the experience mix of the force.

NEC UTILIZATION BY RATING GROUP

NEC utilization rates by rating group are displayed in table 11.[1] The rating groups are listed in descending order by the average number of NECs held per person. One might expect that, the higher the average number of NECs, the lower the utilization rate.[2] However, there is no obvious pattern in utilization rates by number of NECs held. The three rating groups with the fewest NECs per capita--Construction; Deck: other; and Nonrated--generally have the lowest utilization rates. Utilization rates for the Deck: Technical; Ordnance; and Medical groups are generally the highest.

Not only utilization rates, but also changes over time in those rates, vary widely across rating groups. Only four groups--Aviation: highly technical; Aviation: Technical; Deck: technical; and Ordnance--exhibit the same patterns (U1 and PU1 up, U2 and PU2 down) found in the aggregate. Another five groups experienced increases in all four utilization measures between 1979 and 1986. Differences among ratings in the number of NECs that can be earned, NEC requirements, and detailing practices undoubtedly account for much of the difference in utilization patterns.

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1. Measures of utilization by rating group for all fiscal years (1979 through 1986) are given in appendix C.
2. NEC requirements could also affect utilization; these are not accounted for here.

TABLE 11

NEC UTILIZATION BY RATING GROUP

Rating group	U1		U2		PU1		PU2	
	1979	1986	1979	1986	1979	1986	1979	1986
Electronics	.45	.45	.57	.53	.61	.69	.73	.79
Aviation: highly technical	.35	.37	.54	.48	.61	.66	.92	.82
Aviation: technical	.38	.40	.56	.49	.63	.66	.93	.79
Deck: technical	.48	.52	.62	.61	.71	.75	.89	.84
Ordnance	.54	.56	.66	.64	.75	.77	.88	.86
Medical, dental	.59	.62	.62	.66	.72	.74	.76	.78
Precision equipment	.41	.43	.49	.54	.56	.60	.67	.75
Aviation: semitechnical	.42	.41	.62	.50	.61	.63	.89	.75
Engineering, hull	.47	.47	.58	.54	.61	.63	.74	.71
Admin., clerical	.42	.40	.57	.49	.58	.55	.75	.66
Construction	.22	.41	.29	.46	.33	.56	.43	.62
Deck: other	.23	.29	.34	.41	.30	.39	.43	.55
Nonrated	.02	.04	.37	.63	.02	.04	.37	.63
Total	.43	.44	.57	.53	.61	.64	.79	.75

CONCLUSION

RESULTS

This paper has analyzed trends in the inventory of NECs in the Navy and in the utilization of those skills during the early 1980s. During these years, there was a substantial increase in the amount of C-school training conducted by the Navy. This increased training was reflected in an increase in the number of NECs held by Navy personnel.

The growth in the NEC inventory was analyzed to understand the reasons for the increase. The analysis found that almost half of the increase was associated with the increase in the size of the force and with the shift of personnel to more training-intensive ratings. Another portion, close to one-quarter of the growth, was the result of the aging of the force due to higher retention. Even after controlling for all these factors, the evidence suggests that the increase in training resulted in enlisted personnel who were on average more skilled (i.e., held more NECs) than before. How these skills were employed was the issue of interest in the second half of the paper.

Estimates of the utilization of NEC skills were derived by comparing the number of DNECs recorded on the EMR to the inventory of NECs. Five potential definitions of NEC utilization were examined. The strictest definition counted personnel as using their skills only if they were assigned a DNEC that matched one of their NECs. A second measure counted all DNECs, assuming that an individual must be using the skills learned in acquiring another NEC to satisfy the requirements of that billet. A third utilization measure modified the second to account for reporting lags associated with newly earned NECs. The analysis found that the aggregate NEC utilization rate was between .44 and .53 in 1986, depending on the definition used. All three utilization measures changed only slightly over the time period.

A second set of utilization definitions was designed to account for the fact that personnel with multiple NECs could not be using them all simultaneously. As expected, these definitions resulted in higher utilization rate estimates. While these utilization numbers were higher than the first three measures, the trends over time were similar.

Separate analyses of utilization by LOS cell and by rating group were conducted. These analyses found substantial differences in utilization among the various categories, as well as different patterns of variation over time.

FUTURE WORK

This paper has summarized trends in the aggregate NEC inventory and its rate of utilization. Policy decisions need to be made at a much more disaggregated level. Continuing work includes analyzing the

utilization of NEC training at a disaggregate level and studying the impact of other personnel policies--sea-shore rotation and retention policies, for example--on utilization.

One effort involves using longitudinal data to study NEC utilization over time. This effort includes analyzing the length of time an NEC is used during a tour of duty, as well as the frequency with which NECs are used in a second or third tour.

The present paper described how the number of NECs in the inventory has grown and how they have been utilized. Future work will look at how the growth in NECs compares to the growth in NEC requirements. This paper compared the change in the NEC inventory to changes in end-strength and the rating mix, but these are only proxies for the actual change in NEC billet requirements.

Finally, this paper estimated the utilization rate for various definitions of NEC utilization. Utilization rates as estimated by the ratio of DNECs to NECs were found to be around 0.5. The paper did not attempt to determine whether this is an acceptable rate. A fundamental question that needs to be addressed in continuing work on this topic is, what is the appropriate utilization rate?

REFERENCES

[1] CNA Research Memorandum 86-90, *Specialized Skill Training for Enlisted Navy Personnel: A Historical Account*, by Aline O. Quester et al., Apr 1986 (27860090)[1]

[2] CNA Research Memorandum 87-84, *Trends in C-School Skill Training*, by Alan J. Marcus, Jun 1987 (27870084)

[3] Department of the Navy, Bureau of Naval Personnel, NAVPERS 18068D, *Manual of Navy Enlisted Manpower and Personnel Classifications and Occupational Standards: Section II, Navy Enlisted Classifications*, Jan 1985

[4] CNA Research Memorandum 88-23, *Navy Enlisted Classification (NEC) Reporting to the Enlisted Master Record (EMR) File*, by Alan Marcus, Marianne Bowes, and Patricia Byrnes, Feb 1988 (27880023)

1. The number in parentheses is an internal CNA control number.

APPENDIX A

DESCRIPTION OF RATING GROUPS

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DESCRIPTION OF RATING GROUPS

Table A-1 displays the assignment of ratings to rating groups. Thirteen rating groups were used. These were derived from the Navy's standard categorization of ratings into 11 groups. The categorization used here differs from the Navy's in three respects. First, the Medical and Dental groups have been combined. Second, the Aviation group has been broken into three groups--highly technical, technical, and semi-technical. Finally, the Deck group has been split into two groups--technical and other.

TABLE A-1

RATING GROUP DESCRIPTION

Group	Ratecode	Rating
Deck: Other		
	100	BM
	150	MA
	200	QM
	250	SM
Deck: Technical		
	300	OS
	350	EW
	400	ST
	401	STG
	404	STS
	450	OT
	451	OTA
	452	OTM
Ordnance		
	500	TM
	500	TMS
	500	TMT
	600	GM
	601	GMM
	602	GMT
	604	GMG
	610	WT
	700	FC
	800	FT
	801	FTG
	802	FTM
	803	FTB
	810	MT
	900	MN
Electronics		
	1000	ET
	1001	ETN
	1002	ETR
	1010	DS
Precision Equipment		
	1080	PI
	1100	IM
	1200	OM

TABLE A-1 (Continued)

Group	Ratecode	Rating
Admin, Clerical		
	1400	NC
	1500	RM
	1611	CTT
	1622	CTA
	1633	CTM
	1644	CTO
	1655	CTR
	1666	CTI
	1700	YN
	1750	LN
	1800	PN
	1900	DP
	2000	SK
	2100	DK
	2200	MS
	2300	IS
	2490	SH
	2500	RP
	2600	JO
	2700	PC
	3100	LI
	3200	DM
	3300	MU
Engineering, Hull		
	3700	MM
	3800	EN
	3900	MR
	4000	BT
	4020	BR
	4100	EM
	4200	IC
	4300	HT
	4400	GS
	4401	GSE
	4402	GSM
	4600	PM
	4700	ML
Construction		
	5080	CU
	5100	EA
	5300	CE
	5380	EQ
	5410	EO
	5500	CM
	5600	BU

TABLE A-1 (Continued)

GROUP	RATECODE	RATING
Construction		
	5700	SW
	5800	UT
	6000	CA
	6000	CN
	6000	CR
Aviation: Highly Technical		
	6080	AF
	6180	AV
	6300	AT
	6310	AX
	6520	AQ
	6600	AC
	6800	AE
Aviation: Technical		
	6200	AD
	6205	ADR
	6206	ADJ
	6400	AW
	6500	AO
	6900	AM
	7000	PR
	7200	TD
	7500	AS
	7501	ASE
	7502	ASH
	7503	ASM
Aviation: Semi-Technical		
	6700	AB
	6704	ABE
	6705	ABF
	6706	ABH
	6901	AMS
	6902	AMH
	6903	AME
	7100	AG
	7300	AK
	7400	AZ
	7600	PH

TABLE A-1 (Continued)

Medical, Dental		
	8000	HA
	8000	HM
	8000	HN
	8000	HR
	8300	DA
	8300	DN
	8300	DR
	8300	DT
Non-rated		
	3600	SA
	3600	SN
	3600	SR
	5000	FA
	5000	FN
	5000	FR
	7800	AA
	7800	AN
	7800	AR

APPENDIX B

DECOMPOSITION OF THE CHANGE IN THE NEC INVENTORY

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DECOMPOSITION OF THE CHANGE IN THE NEC INVENTORY

To decompose the change in the NEC inventory into four components representing the effects of changes in endstrength, rating mix, LOS mix, and NECs per capita:

Let i refer to LOS group and j to rating group. Define

$w_{ij} = NEC_{ij}/N_{ij}$ = NECs per capita in group ij

$k_j = N_j/N$ = proportion of total employment found in rating group j

$k_{ij} = N_{ij}/N_j$ = proportion of rating group j employment found in LOS group i.

Then the total number of NECs can be expressed as:

$$NEC = \Sigma\Sigma NEC_{ij} = \Sigma\Sigma w_{ij} k_{ij} k_j N \ . \qquad \text{(B-1)}$$

Using (B-1), the change in the number of NECs can be decomposed in two ways. Evaluating the variables being held constant at their means results in

$$\Delta NEC = \Delta N\left(\overline{NEC/N}\right) + \bar{N}\Sigma\Sigma\left(\Delta k_j\right)\left(\overline{w_{ij}}\right)\left(\overline{k_{ij}}\right) + \bar{N}\Sigma\Sigma\left(\Delta k_{ij}\right)\left(\overline{w_{ij}}\right)\left(\overline{k_j}\right) \qquad \text{(B-2)}$$
$$+ \bar{N}\Sigma\Sigma\left(\Delta w_{ij}\right)\left(\overline{N_{ij}/N}\right)$$

where $\Delta X = X_2 - X_1$ is the change in variable X between the initial and final periods and $\bar{X} = .5\left(X_1 + X_2\right)$ is the average of the initial and final values of X.

Alternatively, evaluating the variables being held constant at their initial values results in:

$$\Delta NEC = \Delta N\left(NEC/N\right)_1 + N_1\Sigma\Sigma\left(\Delta k_j\right)w_{ij1}k_{ij1} + N_1\Sigma\Sigma\left(\Delta k_{ij}\right)w_{ij1}k_{j1} \qquad \text{(B-3)}$$
$$+ N_1\Sigma\Sigma\left(\Delta w_{ij}\right)\left(N_{ij}/N\right)_1 + R \ .$$

These two equations can be interpreted as follows. The first term represents the effect of the change in endstrength, holding the rating mix, the LOS mix, and NECs per capita constant. The second term represents the effect of the change in the mix of ratings, holding endstrength, the LOS mix within each rating group, and NECs per capita constant. The third term represents the effect of the change in LOS mix within rating groups, holding endstrength, the ratings mix, and NECs per capita constant. The fourth term represents the effect of the change in average NECs within rating-LOS cells, holding total employment and the distribution of employment constant. In (B-3), R is an interaction term representing a mixture of effects from the four factors.

APPENDIX C

SUPPORTING DATA TABLES

APPENDIX C

SUPPORTING DATA TABLES

This appendix provides supporting data for the tables in the text. Table C-1 gives NEC and DNEC counts by year and LOS group. Table C-2 gives the utilization measures computed for the LOS groups. Tables C-3 and C-4 are analogous to C-1 and C-2 respectively, except by rating group.

TABLE C-1

NEC AND DNEC INVENTORIES BY YEAR AND LOS GROUP

YEAR/ LOS GROUP	Total NECs	Matched DNECs	Total DNECs	Indiv. w/ NEC	Indiv. w/ Match	Indiv. w/ DNEC
1979						
1-4	57534	32269	47582	52007	31475	45510
5-9	71652	35794	46095	51203	33379	41677
10+	139465	47328	59992	73614	42428	52298
TOTAL	268651	115391	153669	176824	107282	139485
1980						
1-4	55500	30863	44692	50247	30161	43125
5-9	71954	35420	45272	50832	32895	40904
10+	139486	46657	58508	73494	41996	51405
TOTAL	266940	112940	148472	174573	105052	135434
1981						
1-4	56932	30734	43566	51909	30049	41881
5-9	77099	37735	47566	53958	34806	42747
10+	143765	47007	58301	75562	42499	51385
TOTAL	277796	115476	149433	181429	107354	136013
1982						
1-4	57674	32640	45456	52879	31885	43770
5-9	84571	41649	52617	59324	38262	46941
10+	148690	48698	60941	78496	43827	53314
TCTAL	290935	122987	159014	190699	113974	144025
1983						
1-4	60500	35282	48526	55192	34239	46485
5-9	95343	47244	59908	66801	43337	53287
10+	155344	52475	66428	82769	46942	57392
TOTAL	311187	135001	174862	204762	124518	157164
1984						
1-4	63302	36944	49988	57262	35303	47338
5-9	102741	50818	62927	71303	46052	55636
10+	164278	55157	68223	86436	48838	58584
TOTAL	330321	142919	181138	215001	130193	161558
1985						
1-4	65026	39543	52453	58334	37661	49370
5-9	111806	54311	66656	76137	49027	58681
10+	176677	59057	72407	91912	52136	61968
TOTAL	353509	152911	191516	226383	138824	170019
1986						
1-4	69139	42632	53737	61161	40508	50534
5-9	116909	58270	68784	77616	52181	60141
10+	189703	65056	77320	97607	57545	66383
TOTAL	375751	165958	199841	236384	150234	177058

TABLE C-2

UTILIZATION MEASURES BY YEAR AND LOS GROUP

Year/ Measure	LOS GROUP 1-4	5-9	+10	TOTAL
1979				
U1	0.561	0.500	0.339	0.430
U2	0.827	0.643	0.430	0.572
PU1	0.605	0.652	0.576	0.607
PU2	0.875	0.814	0.710	0.789
1980				
U1	0.556	0.492	0.334	0.423
U2	0.805	0.629	0.419	0.556
PU1	0.600	0.647	0.571	0.602
PU2	0.858	0.805	0.699	0.776
1981				
U1	0.540	0.489	0.327	0.416
U2	0.765	0.617	0.406	0.538
PU1	0.579	0.645	0.562	0.592
PU2	0.807	0.792	0.680	0.750
1982				
U1	0.566	0.492	0.328	0.423
U2	0.788	0.622	0.410	0.547
PU1	0.603	0.645	0.558	0.598
PU2	0.828	0.791	0.679	0.755
1983				
U1	0.583	0.496	0.338	0.434
U2	0.802	0.628	0.428	0.562
PU1	0.620	0.649	0.567	0.608
PU2	0.842	0.798	0.693	0.768
1984				
U1	0.584	0.495	0.336	0.433
U2	0.790	0.612	0.415	0.548
PU1	0.617	0.646	0.565	0.606
PU2	0.827	0.780	0.678	0.751
1985				
U1	0.608	0.486	0.334	0.433
U2	0.807	0.596	0.410	0.542
PU1	0.646	0.644	0.567	0.613
PU2	0.846	0.771	0.674	0.751
1986				
U1	0.617	0.498	0.343	0.442
U2	0.777	0.588	0.408	0.532
PU1	0.662	0.672	0.590	0.636
PU2	0.826	0.775	0.680	0.749

TABLE C-3

NEC AND DNEC INVENTORIES BY YEAR AND RATING GROUP

Year Rating Group	Total NECs	Matched DNECs	Total DNECs	Indiv. w/ NEC	Indiv. w/ match	Indiv. w/ DNEC
1979						
DECK	6400	1489	2148	4957	1488	2142
DECK_TECH	16099	7716	9994	9830	6938	8755
ORDNAN	18643	10135	12363	12582	9392	11047
ELECTR	25245	11322	14460	16302	9890	11906
PRECIS	486	198	238	322	180	216
ADMIN	47069	19579	26892	31017	17876	23319
ENGINE	48859	22974	28333	34366	21035	25448
CONSTR	4014	897	1157	2639	879	1135
AV_HI	31556	11067	16900	17444	10651	15959
AVTECH	28071	10563	15734	16325	10250	15203
AVSEMI	21678	9039	13422	14575	8870	13017
MEDIC	17521	10344	10919	13476	9765	10235
GENDET	3010	68	1109	2989	68	1103
UNKWN	0	0	0	0	0	0
TOTAL	268651	115391	153669	176824	107282	139485
1980						
DECK	6188	1439	2065	4802	1438	2038
DECK_TECH	16956	8281	10561	10267	7385	9146
ORDNAN	19054	10181	12449	12694	9387	11212
ELECTR	25478	11875	15701	15873	10274	13037
PRECIS	509	192	251	318	173	228
ADMIN	46516	18191	24248	30363	16732	21429
ENGINE	48006	21808	26782	33541	20187	24369
CONSTR	3233	709	953	2307	705	946
AV_HI	31020	11084	16247	17128	10638	15405
AVTECH	27778	10125	14610	16164	9846	14107
AVSEMI	21053	8597	11926	14172	8416	11605
MEDIC	17435	10309	11223	13251	9724	10468
GENDET	3716	149	1456	3694	147	1444
UNKWN	0	0	0	0	0	0
TOTAL	266942	112940	148472	174574	105052	135434

TABLE C-3 (Continued)

Year/ Rating Group	Total NECs	Matched DNECs	Total DNECs	Indiv. w/ NEC	Indiv. w/ match	Indiv. w/ DNEC
1981						
DECK	6344	1445	2029	4883	1444	1980
DECK_TECH	17736	8658	11097	10784	7677	9476
ORDNAN	20016	10498	12313	13075	9637	11055
ELECTR	26882	12627	16434	16325	10747	13327
PRECIS	546	193	254	334	171	222
ADMIN	48435	18978	25077	31647	17333	22174
ENGINE	50553	22128	26478	35524	20832	24425
CONSTR	3249	773	1018	2344	760	996
AV_HI	31470	10986	15956	17300	10595	15157
AVTECH	29117	10203	14687	17092	9919	14184
AVSEMI	21582	8349	11379	14482	8156	11057
MEDIC	17809	10531	11555	13619	9978	10814
GENDET	4058	107	1156	4021	105	1146
UNKWN	0	0	0	0	0	0
TOTAL	277797	115476	149433	181430	107354	136013
1982						
DECK	6591	1662	2209	5035	1656	2165
DECK_TECH	19776	9410	12055	12024	8326	10228
ORDNAN	20513	10391	12608	13245	9443	11168
ELECTR	27709	13478	16856	16628	11339	13495
PRECIS	601	230	301	371	206	260
ADMIN	51114	20445	26480	33723	18575	23289
ENGINE	52838	22896	27617	37253	21617	25500
CONSTR	3594	935	1124	2606	925	1108
AV_HI	32878	11764	17567	18421	11269	16543
AVTECH	30278	11209	15992	17974	10867	15336
AVSEMI	22761	8879	11740	15410	8689	11390
MEDIC	18854	11559	12893	14610	10935	11984
GENDET	3428	129	1572	3399	127	1559
UNKWN	0	0	0	0	0	0
TOTAL	290935	122987	159014	190699	113974	144025

TABLE C-3 (Continued)

Year/ Rating Group	Total NECs	Matched DNECs	Total DNECs	Indiv. w/ NEC	Indiv. w/ match	Indiv. w/ DNEC
1983						
DECK	6877	1840	2536	5283	1835	2482
DECK_TECH	21489	10578	13442	13104	9275	11415
ORDNAN	21523	11502	13835	14033	10398	12182
ELECTR	29709	14165	18832	17851	11886	14822
PRECIS	704	282	353	425	249	297
ADMIN	53895	20814	28519	35815	19008	24972
ENGINE	55909	24712	29553	39645	23094	26984
CONSTR	3983	1218	1435	2842	1176	1385
AV_HI	36553	14076	19773	20679	13400	18612
AVTECH	32116	13133	18014	19213	12367	16748
AVSEMI	25231	10324	13399	16937	10083	12976
MEDIC	19671	12106	13305	15442	11499	12437
GENDET	3527	251	1866	3493	248	1852
UNKWN	0	0	0	0	0	0
TOTAL	311187	135001	174862	204762	124518	157164
1984						
DECK	7213	2021	2641	5506	2018	2597
DECK_TECH	21808	10918	14290	13132	9442	11947
ORDNAN	22937	12350	14452	14833	11106	12694
ELECTR	32594	16206	20432	19244	13138	15855
PRECIS	780	289	396	460	252	327
ADMIN	54295	21186	27488	35904	19158	24065
ENGINE	61202	27351	32448	42771	25091	29163
CONSTR	4226	1500	1712	2986	1446	1642
AV_HI	39473	14777	20220	22112	14068	19010
AVTECH	33339	12992	17122	19465	12103	15683
AVSEMI	27421	10584	13701	18117	10345	13273
MEDIC	21040	12545	14006	16510	11830	13080
GENDET	3993	200	2230	3961	196	2222
UNKWN	0	0	0	0	0	0
TOTAL	330321	142919	181138	215001	130193	161558

TABLE C-3 (Continued)

Year/ Rating Group	Total NECs	Matched DNECs	Total DNECs	Indiv. w/ NEC	Indiv. w/ match	Indiv. w/ DNEC
1985						
DECK	7707	2121	2808	5799	2115	2769
DECK_TECH	23862	12002	15019	14733	10512	12478
ORDNAN	23173	12508	15742	15374	11350	13809
ELECTR	37668	17912	22083	20603	14425	16946
PRECIS	838	290	465	497	249	391
ADMIN	57806	22339	28561	37946	20090	24967
ENGINE	66525	30452	35861	45764	27587	31930
CONSTR	4577	1653	1848	3149	1560	1734
AV_HI	41975	15552	20601	23271	14865	19374
AVTECH	34640	13519	17306	19502	12466	15744
AVSEMI	29070	11189	14057	18819	10954	13649
MEDIC	21918	13208	14874	17201	12488	13946
GENDET	3752	166	2291	3726	163	2282
UNKWN	0	0	0	0	0	0
TOTAL	353511	152911	191516	226384	138824	170019
1986						
DECK	8392	2451	3481	6292	2446	3443
DECK_TECH	25939	13461	15878	15734	11735	13187
ORDNAN	26500	14741	16960	17297	13347	14859
ELECTR	40547	18109	21478	21250	14597	16728
PRECIS	900	384	489	544	326	406
ADMIN	57554	23146	28249	38138	21087	25111
ENGINE	72309	33687	39213	48360	30280	34440
CONSTR	4927	2017	2244	3362	1869	2072
AV_HI	44603	16618	21353	24064	15757	19722
AVTECH	36769	14720	17975	20340	13331	16105
AVSEMI	31199	12737	15446	19677	12359	14844
MEDIC	22302	13748	14680	17545	12963	13752
GENDET	3788	138	2390	3765	136	2384
UNKWN	22	1	5	16	1	5
TOTAL	375751	165958	199841	236384	150234	177058

TABLE C-4

NEC UTILIZATION MEASURES BY YEAR AND RATING GROUP

	U1	U2	PU1	PU2
1979				
DECK	0.233	0.336	0.300	0.432
DECK_TECH	0.479	0.621	0.706	0.891
ORDNAN	0.544	0.663	0.746	0.878
ELECTR	0.448	0.573	0.607	0.730
PRECIS	0.407	0.490	0.559	0.671
ADMIN	0.416	0.571	0.576	0.752
ENGINE	0.470	0.580	0.612	0.740
CONSTR	0.223	0.288	0.333	0.430
AV_HI	0.351	0.536	0.611	0.915
AVTECH	0.376	0.561	0.628	0.931
AVSEMI	0.417	0.619	0.609	0.893
MEDIC	0.590	0.623	0.725	0.759
GENDET	0.023	0.368	0.023	0.369
UNKWN	0.000	0.000	0.000	0.000
TOTAL	0.430	0.572	0.607	0.789
1980				
DECK	0.233	0.334	0.299	0.424
DECK_TECH	0.488	0.623	0.719	0.891
ORDNAN	0.534	0.653	0.739	0.883
ELECTR	0.466	0.616	0.647	0.821
PRECIS	0.377	0.493	0.544	0.717
ADMIN	0.391	0.521	0.551	0.706
ENGINE	0.454	0.558	0.602	0.727
CONSTR	0.219	0.295	0.306	0.410
AV_HI	0.357	0.524	0.621	0.899
AVTECH	0.364	0.526	0.609	0.873
AVSEMI	0.408	0.566	0.594	0.819
MEDIC	0.591	0.644	0.734	0.790
GENDET	0.040	0.392	0.040	0.391
UNKWN	0.000	0.000	0.000	0.000
TOTAL	0.423	0.556	0.602	0.776

TABLE C-4 (continued)

	U1	U2	PU1	PU2
1981				
DECK	0.228	0.320	0.296	0.405
DECK_TECH	0.488	0.626	0.712	0.879
ORDNAN	0.524	0.615	0.737	0.846
ELECTR	0.470	0.611	0.658	0.816
PRECIS	0.353	0.465	0.512	0.665
ADMIN	0.392	0.518	0.548	0.701
ENGINE	0.438	0.524	0.586	0.688
CONSTR	0.238	0.313	0.324	0.425
AV_HI	0.349	0.507	0.612	0.876
AVTECH	0.350	0.504	0.580	0.830
AVSEMI	0.387	0.527	0.563	0.763
MEDIC	0.591	0.649	0.733	0.794
GENDET	0.026	0.285	0.026	0.285
UNKWN	0.000	0.000	0.000	0.000
TOTAL	0.416	0.538	0.592	0.750
1982				
DECK	0.252	0.335	0.329	0.430
DECK_TECH	0.476	0.610	0.692	0.851
ORDNAN	0.507	0.615	0.713	0.843
ELECTR	0.486	0.608	0.682	0.812
PRECIS	0.383	0.501	0.555	0.701
ADMIN	0.400	0.518	0.551	0.691
ENGINE	0.433	0.523	0.580	0.685
CONSTR	0.260	0.313	0.355	0.425
AV_HI	0.358	0.534	0.612	0.898
AVTECH	0.370	0.528	0.605	0.853
AVSEMI	0.390	0.516	0.564	0.739
MEDIC	0.613	0.684	0.748	0.820
GENDET	0.038	0.459	0.037	0.459
UNKWN	0.000	0.000	0.000	0.000
TOTAL	0.423	0.547	0.598	0.755

TABLE C-4 (Continued)

	U1	U2	PU1	PU2
1983				
DECK	0.268	0.369	0.347	0.470
DECK_TECH	0.492	0.626	0.708	0.871
ORDNAN	0.534	0.643	0.741	0.868
ELECTR	0.477	0.634	0.666	0.830
PRECIS	0.401	0.501	0.586	0.699
ADMIN	0.386	0.529	0.531	0.697
ENGINE	0.442	0.529	0.583	0.681
CONSTR	0.306	0.360	0.414	0.487
AV_HI	0.385	0.541	0.648	0.900
AVTECH	0.409	0.561	0.644	0.872
AVSEMI	0.409	0.531	0.595	0.766
MEDIC	0.615	0.676	0.745	0.805
GENDET	0.071	0.529	0.071	0.530
UNKWN	0.000	0.000	0.000	0.000
TOTAL	0.434	0.562	0.608	0.768
1984				
DECK	0.280	0.366	0.367	0.472
DECK_TECH	0.501	0.655	0.719	0.910
ORDNAN	0.538	0.630	0.749	0.856
ELECTR	0.497	0.627	0.683	0.824
PRECIS	0.371	0.508	0.548	0.711
ADMIN	0.390	0.506	0.534	0.670
ENGINE	0.447	0.530	0.587	0.682
CONSTR	0.355	0.405	0.484	0.550
AV_HI	0.374	0.512	0.636	0.860
AVTECH	0.390	0.514	0.622	0.806
AVSEMI	0.386	0.500	0.571	0.733
MEDIC	0.596	0.666	0.717	0.792
GENDET	0.050	0.558	0.049	0.561
UNKWN	0.000	0.000	0.000	0.000
TOTAL	0.433	0.548	0.606	0.751

TABLE C-4 (Continued)

	U1	U2	PU1	PU2
1985				
DECK	0.275	0.364	0.365	0.477
DECK_TECH	0.503	0.629	0.714	0.847
ORDNAN	0.540	0.679	0.738	0.898
ELECTR	0.476	0.586	0.700	0.823
PRECIS	0.346	0.555	0.501	0.787
ADMIN	0.386	0.494	0.529	0.658
ENGINE	0.458	0.539	0.603	0.698
CONSTR	0.361	0.404	0.495	0.551
AV_HI	0.371	0.491	0.639	0.833
AVTECH	0.390	0.500	0.639	0.807
AVSEMI	0.385	0.484	0.582	0.725
MEDIC	0.603	0.679	0.726	0.811
GENDET	0.044	0.611	0.044	0.612
UNKWN	0.000	0.000	0.000	0.000
TOTAL	0.433	0.542	0.613	0.751
1986				
DECK	0.292	0.415	0.389	0.547
DECK_TECH	0.519	0.612	0.746	0.838
ORDNAN	0.556	0.640	0.772	0.859
ELECTR	0.447	0.530	0.687	0.787
PRECIS	0.427	0.543	0.599	0.746
ADMIN	0.402	0.491	0.553	0.658
ENGINE	0.466	0.542	0.626	0.712
CONSTR	0.409	0.455	0.556	0.616
AV_HI	0.373	0.479	0.655	0.820
AVTECH	0.400	0.489	0.655	0.792
AVSEMI	0.408	0.495	0.628	0.754
MEDIC	0.616	0.658	0.739	0.784
GENDET	0.036	0.631	0.036	0.633
UNKWN	0.045	0.227	0.063	0.313
TOTAL	0.442	0.532	0.636	0.749